

NEW GENERA AND SPECIES OF DEEP-SEA
MACELICEPHALINAE AND HARMOTHOINAE
(POLYCHAETA: POLYNOIDAE) FROM THE
HYDROTHERMAL RIFT AREAS OFF THE GALAPAGOS
AND WESTERN MEXICO AT 21°N AND FROM
THE SANTA CATALINA CHANNEL

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Abstract. — *Levensteiniella kincaidi*, n. gen., n. sp. and *Macellicephala galapagensis*, n. sp., in the Macellicephalinae, and *Harmothoe macnabi*, n. sp., in the Harmothoinae, from the hydrothermal vent areas on the Galapagos Rift and off the East Pacific Rise at 21°N are described, as well as a deep-water pelagic macellicephalin, *Natopolynoe kensmithi*, n. gen., n. sp., from the Santa Catalina Channel. A summary of the polynoid polychaetes collected during *Alvin* dives by the Galapagos Rift Biology Expedition in 1979 and the OASIS Expedition to the East Pacific Rise in 1982 is included, along with a key to the species.

The present paper covers the remaining polynoid polychaetes collected in the hydrothermal vents of the Galapagos Rift and the East Pacific Rise at 21°N off Western Mexico, during dives of the DSRV *Alvin* by the Galapagos Rift Biology Expedition in 1979 and the OASIS Expedition in 1982. Included in this report are specimens referred to the subfamily Macellicephalinae, represented by a new genus and species from both vent areas, and a new species of *Macellicephala* from the Galapagos Rift, and to the Harmothoinae, a new species of *Harmothoe* from the Galapagos Rift. The specimens were sent to me by J. F. Grassle and I. Williams of the Woods Hole Oceanographic Institution. The major part of the collection has been dealt with previously in six papers (Pettibone 1983, 1984a, b, 1985b, c, d). A summary of the identifications on this material is given at the conclusion of this paper, including a key to the subfamilies, genera, and species.

Also included is the description of a new genus and species of Macellicephalinae, collected during a dive of the *Alvin* in 1979 in the Santa Catalina Channel by K. L. Smith using a slurp gun-respirometer. The specimen was sent to me by Susan Hamilton and K. L. Smith of Scripps Institution of Oceanography, along with some observations on the habitat of the species.

The types are deposited in the National Museum of Natural History, Smithsonian Institution (USNM).

Subfamily Macellicephalinae Hartmann-Schröder, 1971,
emended Pettibone, 1976

Levensteiniella, new genus

Type-species. — *Levensteiniella kincaidi*, new species. Gender: feminine.

Diagnosis. — Body short, flattened, fusiform; segments up to 25 (first achaetous). Elytra and prominent elytophores 11 pairs, on segments 2, 4, 5, 7, alternate

segments to 21. Elytra delicate, without tubercles. Prostomium deeply bilobed, anterior lobes triangular, with frontal filaments; median antenna with small ceratophore in anterior notch and short style; paired palps moderately long; without lateral antennae and eyes. First or tentacular segment not visible dorsally; tentaculophores lateral to prostomium, achaetous, with 2 pairs of tentacular cirri. Segment 2 with buccal cirri longer than following ventral cirri, attached to basal part of parapodia lateral to mouth. Parapodia biramous, both rami well developed, conical, with projecting acicular processes; notopodia shorter than neuropodia. Notosetae very numerous, stouter than neurosetae, with spinous rows and blunt tips.

Neurosetae very numerous, spinous, with slightly hooked and tapered tips (not flattened). Dorsal cirri with bulbous cirrophores and moderately long styles; dorsal tubercles nodular. Ventral cirri short. With or without elongate ventral papillae on segments 11 and 12. Pygidium small, rectangular, with pair of anal cirri. Pharynx with 7 pairs of papillae (none enlarged) and 2 pairs of jaws (not denticled).

Etymology. — The genus is named for Raisa J. Levenstein, in recognition of her interesting studies on deep-sea polychaetes, including members of the Macellicephalinae.

Remarks. — *Levensteiniella* differs from the other genera of Macellicephalinae in having 11 pairs of elytra and up to 25 segments. Among the genera added to this subfamily, Levenstein (1982:1293–1294, figs. e–h) added *Bathynotalia perplexa* from the Tasman Sea, with 11 pairs of elytra and 21 segments (elytra with an unusual distribution: on segments 2, 4, 5, 7, alternate segments to 17, 18, and 20). On the figure of the prostomium (fig. e), she showed the presence of long lateral antennae inserted ventrally (not mentioned in the text). Thus it should be referred to Harmothoinae, rather than Macellicephalinae.

Levensteiniella kincaidi, new species

Figs. 1–3

Material examined. — Pacific Ocean off Western Mexico, 20°50'N, 109°06'W, *Alvin* dives in 1982: Dive 1213, 19 Apr, 2617 m, scoop sample near black smokers, paratype (young, USNM 97455). — Dive 1214, 20 Apr, 2633 m, vestimentiferan wash, 13 paratypes (10 young, USNM 97456). — Dive 1215-5b, 21 Apr, 2616 m, slurp sample, 2 paratypes (young, USNM 97457). — Dive 1218-15, 24 Apr, 2618 m, clam and crab trap wash, 4 paratypes (3 young, USNM 97458). — Dive 1219, 25 Apr, 2612 m, 10A & B, *Riftia* and clam wash, coarse and fine fractions, 1A & B, slurp samples in *Riftia* habitat, 10 paratypes (9 young, USNM 97459). — Dive 1221-15, 4 May, 2618 m, *Riftia* and *Calyptogena* wash, coarse and fine fractions, holotype (USNM 97452), 4 paratypes (USNM 97453) and 72 paratypes (65 young, USNM 97454). — Dive 1222-5b, 6 May, 2614 m, rubble sample from *Calyptogena* residue, 12 paratypes (young, USNM 97460). — Dive 1223-11, -17, 7 May, 2616 m, rubble, 13 paratypes (11 young, USNM 97461). — Dive 1226-7, 10 May, 2616 m, *Riftia*, *Calyptogena* and *Alvinella* wash, 2 paratypes (young, USNM 97462). — Dive 1227, box core 2, 11 May, 2616 m, very loose black sediment, paratype (young USNM 97463).

East central Pacific, from dives of the *Alvin* on 3 vent areas along the Galapagos Rift in 1979: MUSSEL BED, 00°47'53"N, 86°09'12"W: Dive 880, 21 Jan, 2493

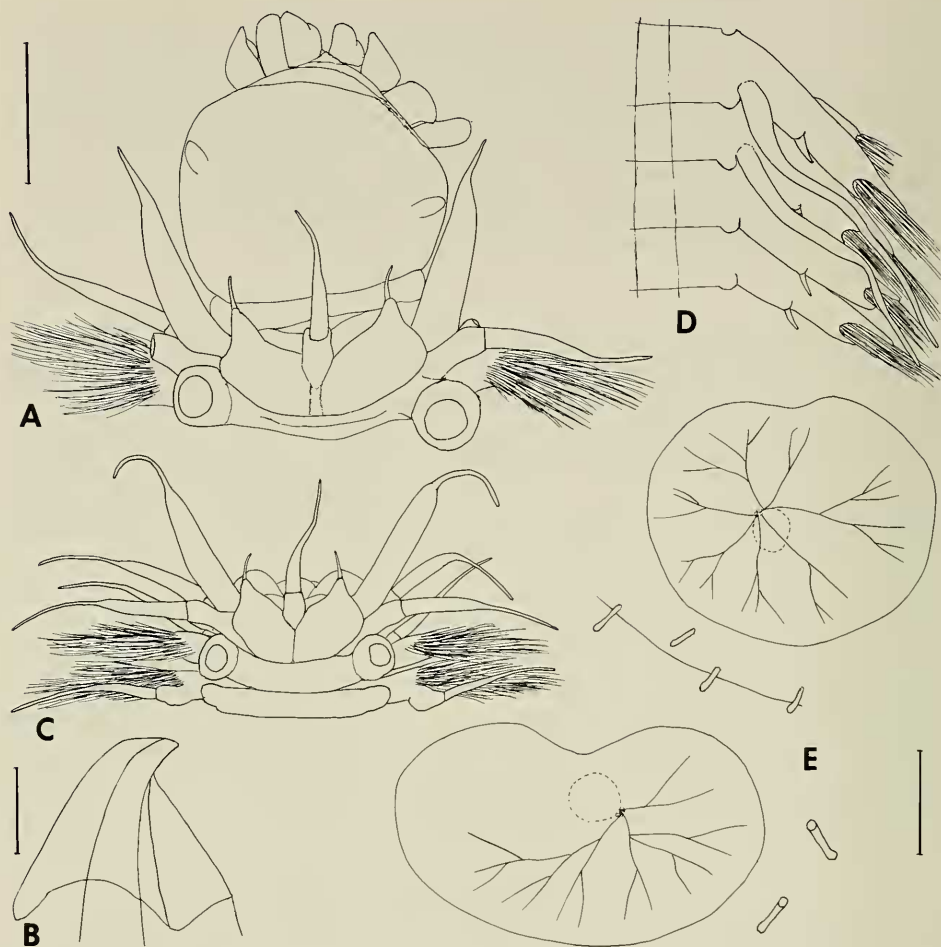


Fig. 1. *Levensteiniella kincaidi*, A, B, Holotype, USNM 97452; C, D, Paratype, USNM 97453; E, Paratype, USNM 97454; A, Dorsal view of anterior end, with pharynx fully extended; B, Isolated jaw; C, Dorsal view of anterior end; D, Ventral view of right side of segments 11 to 14, showing elongate ventral papillae on segments 11 and 12; E, Left first and right middle elytra, with detail of micropapillae. Scales = 1.0 mm for A, C, D; 0.2 mm for B; 0.5 mm for E.

m, mussel washings, 9 paratypes (8 young, USNM 97464).—ROSE GARDEN, 00°48'15"N, 86°13'28"W: Dive 894, 19 Feb, 2457 m, amphipod trap, 9 paratypes (young, USNM 80640-1).—Dive 983-113, 30 Nov, 2457 m, washings, 3 paratypes (young, USNM 97467).—Dive 984-32, 1 Dec, 2451 m, 5 paratypes (4 young, USNM 97468).—GARDEN OF EDEN, 00°47'41"N, 86°07'44"W: Dive 883, 25 Jan, 2493 m, slurp sample in mussel area, 6 paratypes (young, USNM 97465).—Dive 884, 25 Jan, 2482 m, clam bucket with mussels, 3 paratypes (young, USNM 97466).

Description.—Length of holotype 12 mm, width 5 mm with setae, segments 25, last one small. For additional adults with more than 21 segments and full number of 11 pairs of elytra, lengths 5 to 11 mm, widths 4 to 6 mm, segments 22 to 24.

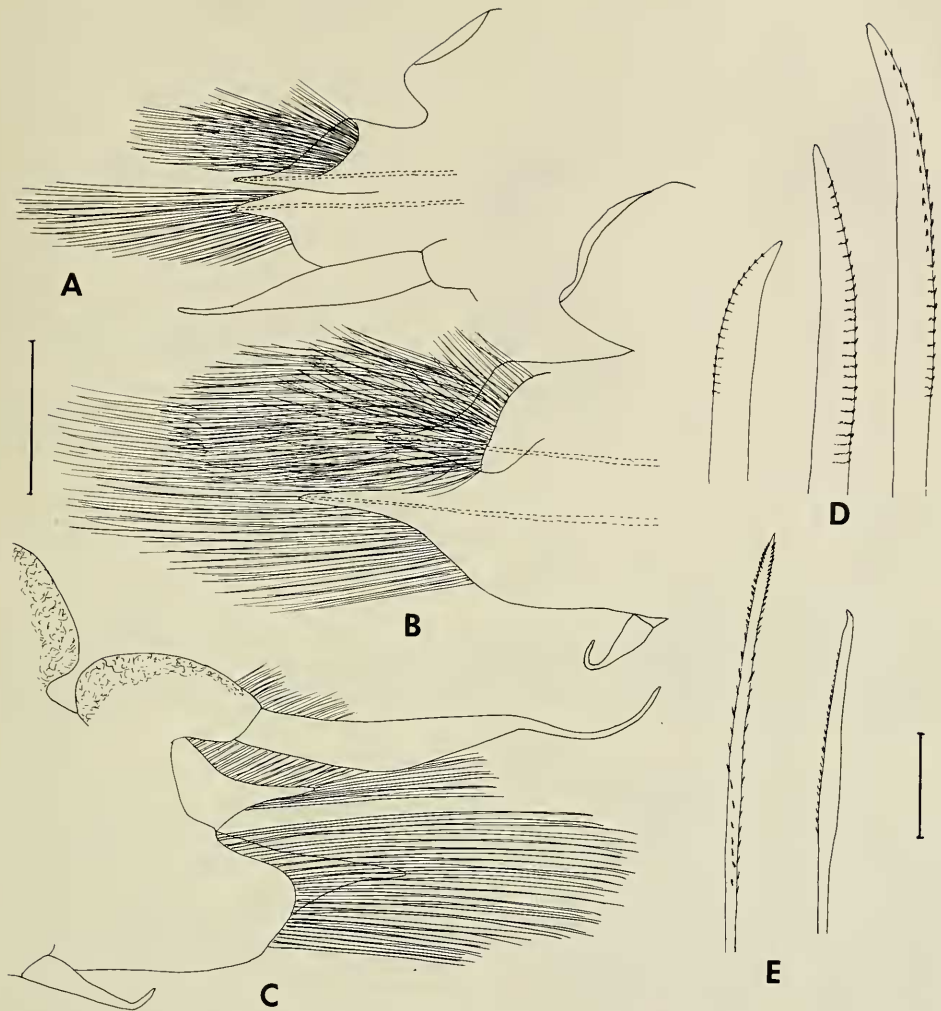


Fig. 2. *Levensteiniella kincaidi*, holotype, USNM 97452: A, Right elytrigerous parapodium of segment 2, anterior view, acicula dotted; B, Same of segment 9; C, Right cirriferous parapodium of segment 10, posterior view; D, Short and long notosetae; E, Supra-acicular and subacicular neurosetae. Scales = 0.5 mm for A-C; 0.1 mm for D, E.

The body is oval, flattened, tapering slightly anteriorly and posteriorly, with parapodia longer than the body width. The 11 pairs of elytra cover the dorsum. They are round to subreniform, delicate, with "veins" and scattered micropapillae near the border and on the surface (Fig. 1E). The elytophores are large and prominent (Figs. 1A, C, 2A, B). Dorsal cirri, on the segments lacking elytra, have cylindrical cirrophores, bulbous basally, attached to the posterodorsal sides of the notopodia; the styles, with long slender tips, extend to the tips of the setae or beyond; the dorsal tubercles are nodular (Figs. 1C, 2C). Transverse ciliated bands, 2 per segment, extend on the bases of the elytophores and dorsal tubercles.

The prostomium is oval, bilobed, wider than long; the anterior lobes are triangular and extended laterally, with delicate frontal filaments; the short cerato-

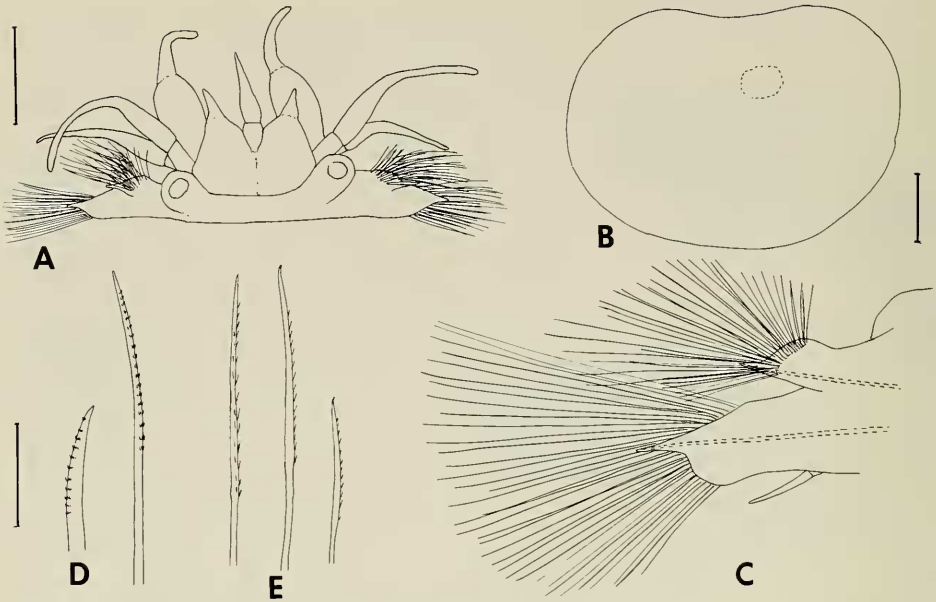


Fig. 3. *Levensteiniella kincaidi*, young paratype of 14 segments, 2×1.5 mm, USNM 97468: A, Dorsal view anterior end; B, Right elytron; C, Right elytrigerous parapodium, anterior view, acicula dotted; D, Short and long notosetae; E, Upper, middle and lower neurosetae. Scales = 0.2 mm for A; 0.1 mm for B, C; 0.1 mm for D, E.

phore of the median antenna is inserted in the anterior notch; in the style is short, subulate, with a long terminal filament; the palps are stout, tapered, with long slender tips; lateral antennae and eyes are lacking (Fig. 1A, C). The tentaculophores lateral to the prostomium lack setae; the 2 pairs of tentacular cirri, with long slender tips, are slightly shorter than the palps, the dorsal pair longer than the ventral pair. The low bilobed facial tubercle occupies the space between the anterior lobes of the prostomium.

The second or buccal segment bears the first pair of elytriphores, biramous parapodia, with the rami equal in length, and buccal cirri, similar to the tentacular cirri, attached basally on the neuropodia lateral to the ventral mouth (Figs. 1A, C, 2A). The everted pharynx usually has 7 pairs of similar papillae around the opening (Fig. 1A; one specimen with 7 dorsal and 6 ventral; one with 7 dorsal and 9 ventral). The 2 pairs of jaws are entire, not denticled (Fig. 1B).

Both rami of the biramous parapodia are well developed, the notopodia slightly shorter than the neuropodia, except for the buccal segment (Fig. 2B, C). The notopodia are round with a projecting acicular process on the lower side. The golden notosetae are very numerous, of 3 to 4 lengths, none as long as the neurosetae; the shortest anterior group projects dorsally. The notosetae are stouter than the neurosetae, slightly curved with spinous rows and short tapered bare blunt tips (Fig. 2D). The neuropodia have conical presetal lobes with a projecting acicular process and shorter rounded postsetal lobes. The neurosetae are very numerous, golden-colored, and slender (none extra wide or flattened); the supra-acicular ones have longer spinous regions, more prominent spines and tapered,

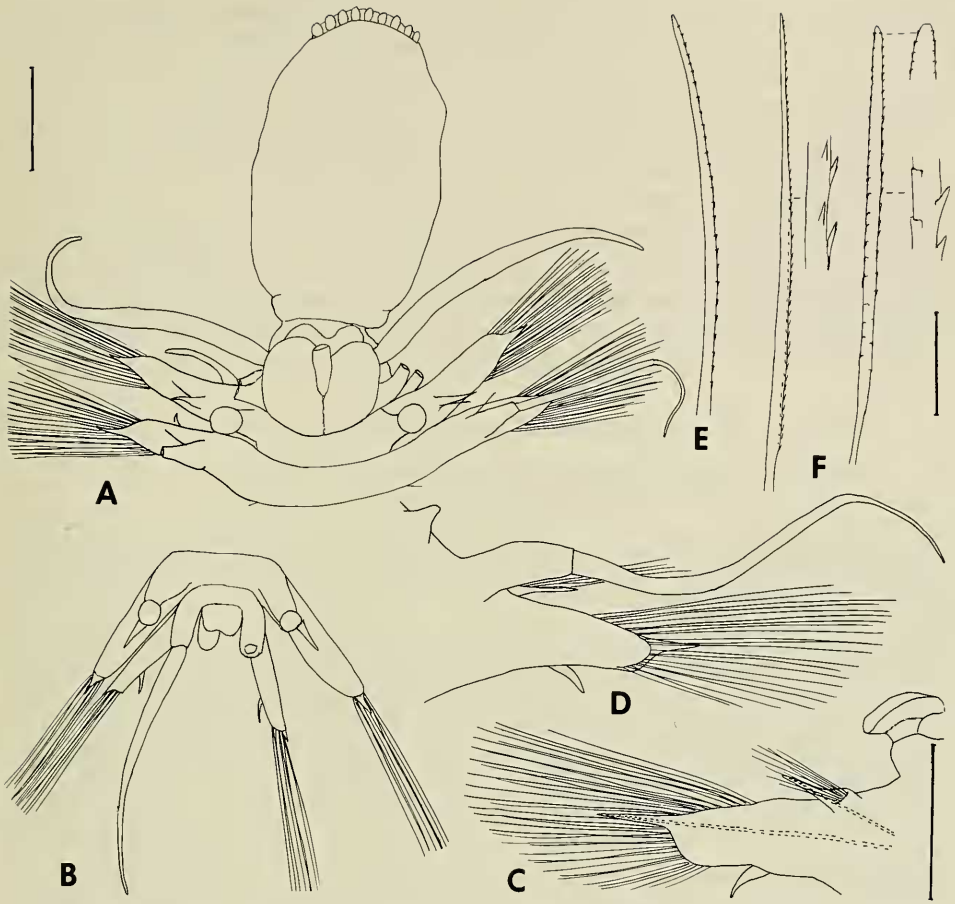


Fig. 4. *Macellicephalo galapagensis*, holotype, USNM 80638: A, Dorsal view of anterior end, pharynx extended; styles of median antenna, right and left tentacular cirri, and left dorsal cirrus of segment 3 missing; B, Dorsal view of posterior end, styles of right dorsal cirrus of segment 18 and anal cirri missing; C, Right elytrigerous parapodium, anterior view, acicula dotted; D, right cirriferous parapodium, posterior view; E, Notoseta; F, Neurosetae, with detail of part. Scales = 0.5 mm for A, B; 0.5 mm for C, D; 0.1 mm for E, F.

flattened, finely spinous tips; the subacicular ones are finely spinous with slightly hooked tips (Fig. 2E). The ventral cirri are short, tapered, attached on the middle of the neuropodia (Fig. 2B, C).

The pygidium is small, rectangular, with a pair of small anal cirri (mostly missing). Some of the adult paratypes have 2 pairs of very long ventral papillae (containing a whitish secretion) on segments 11 and 12 (Fig. 1D). They were found on adults 5.5 to 11 mm in length, 3 to 5 mm in width, with 22 to 24 segments. Some smaller young individuals (3 to 3.5 mm in length, 3 mm in width, with 16 to 19 segments) had a pair of long ventral papillae on segment 11 only.

Numerous young specimens were collected, with lengths of 1 to 4 mm, widths of 1 to 3 mm, and segments 10 to 20. They show the general characters of the adult. A small one, 2 mm long, 1.5 wide, with 14 segments, is shown on Fig. 3.

The styles of the median antenna and tentacular cirri and the palps are more bulbous basally (Fig. 3A). The delicate oval elytra lack micropapillae (Fig. 3B). The notopodia are not as well developed and the setae are more slender (Fig. 3C–E).

Etymology. — The species is named for the late Trevor Kincaid, Professor at the University of Washington, who first suggested that I work on my chosen field of polychaetes.

Distribution. — Eastern Pacific in the Galapagos Rift area in 2457–2493 meters, associated with deep-sea mussels and giant clams and in the East Pacific Rise at 21°N in 2612–2633 meters, associated with vestimentiferans (*Riftia pachyptila* Jones), giant clams (*Calyptogena magnifica* Boss and Turner) and ampharetid polychaetes (*Alvinella pompejana* Desbruyères and Laubier).

Genus *Macellicephala* McIntosh, 1885, emended Pettibone, 1976

Macellicephala galapagensis, new species

Fig. 4

Material examined. — East central Pacific, from *Alvin* dive in Galapagos Rift in 1979: ROSE GARDEN, 00°48'15"N, 86°13'28"W, Dive 894, 19 Feb, amphipod trap, holotype (USNM 80638).

Description. — The holotype, a male with sperm, is 6 mm long, 4 mm wide with setae, with 18 segments, the first achaetous. The body is subrectangular, flattened, with long and well separated parapodia, longer than the body width (Fig. 4A, B). No color remains. There are 9 pairs of very small elytra, firmly attached on prominent elytophores on segments 2, 4, 5, 7, 9, 11, 13, 15, and 17 (Fig. 4A–C). The elytra are rather thick, without tubercles or papillae. The dorsal cirri, attached on the posterodorsal sides of the notopodia, have long cylindrical cirrophores and long, slender, smooth styles extending beyond the tips of the setae; the dorsal tubercles are small, conical, beginning on segment 6 (Fig. 4A, B, D).

The prostomium is bilobed, the anterior margins rounded, without peaks or filaments; the median antenna has a long ceratophore in the middle of the prostomium, the style is missing; the palps are long, stout, smooth and tapered; lateral antennae and eyes are lacking (Fig. 4A). The first or tentacular segment is not visible dorsally; the tentaculophores lateral to the prostomium lack setae and bear 2 pairs of tentacular cirri; the styles are missing; the facial tubercle is large and bilobed (Fig. 4A). The second or buccal segment bears the first pair of small elytra, biramous parapodia and ventral buccal cirri longer than the following ventral cirri (Fig. 4A). The ventral mouth is enclosed in segments 1 and 2. The pharynx is completely extended, with the opening encircled with 9 pairs of equal dorsal and ventral papillae, with 2 pairs of entire jaws (Fig. 4A).

The long parapodia are biramous, with the notopodia much shorter than the neuropodia (Figs. 4C, D). The notopodium is conical with a projecting acicular process on the lower side. The neuropodium has a conical presetal lobe abruptly tapering to a prominent acicular process, the postsetal lobe is shorter and rounded. The notosetae are few (0–7), a single one on the parapodia of segments 2 and 3; they are slender, about as stout as the neurosetae, with widely-spaced spinous rows and rounded tips (Fig. 4E). The neurosetae are numerous, forming fan-shaped bundles; they are delicate, flattened, with double rows of widely-spaced

spines and tapered rounded tips (Fig. 4F). The ventral cirri are short, tapering, attached to the middle of the neuropodia (Figs. 4C, D).

The nephridial papillae are indistinct, none enlarged. The pygidium is a rounded lobe wedged between the long parapodia of the last segment, with a pair of anal cirri, only the base of the left one remains (Fig. 4B).

Etymology. — The species is named for the type-locality, the Galapagos Rift.

Remarks. — *Macellicephala galapagensis* is distinguished from the other species of *Macellicephala* by the very small and firmly attached elytra. Where known in other species of the genus, the elytra are large and easily broken off. The tentacular segment is not visible dorsally, as it is in other members of *Macellicephala*. The parapodia of the last segment are large and not reduced, as they are in other species of *Macellicephala*.

Natopolynoe, new genus

Type-species. — *Natopolynoe kensmithi*, new species. Gender: feminine.

Diagnosis. — Body short, flattened, fusiform; segments 17 (perhaps more?). Elytra and small elytophores 9 pairs, on segments 2, 4, 5, 7, 9, 11, 13, 15, and 17; elytra delicate, without tubercles. Prostomium deeply bilobed, rounded, without frontal filaments; median antenna with slender ceratophore in anterior notch, with long style; paired palps very long; without lateral antennae and eyes. First or tentacular segment visible dorsally; tentaculophores lateral to prostomium, achaeitous, with 2 pairs of tentacular cirri. Parapodia biramous, both rami well developed, with projecting acicular processes. Both notosetae and neurosetae delicate, transparent, flattened, serrated on sides. Dorsal cirri with cylindrical cirrophores and very long styles; dorsal tubercles indistinct. Ventral cirri short. Pygidium small, rounded, with anal cirri (?). Pharynx with 9 pairs of equal papillae and 2 pairs of entire jaws.

Etymology. — *Nato* (Latin), swim, plus *polynoe*, referring to the swimming polynoid worm.

Natopolynoe kensmithi, new species

Fig. 5

Material examined. — California, Santa Catalina Channel, 33°18'24"N, 118°35'37"W, *Alvin* dive 929, 19 Jun 1979, 1300 m, K. L. Smith, collector, holotype (USNM 97450).

Description. — The holotype, with 17 segments, has a length of 7 mm, a width of 1.5 mm without parapodia, 4 mm with parapodia, and 6 mm with setae. The body is flattened ventrally and arched dorsally, with very long parapodia, much longer than the body width. The integument is delicate and transparent, revealing the dark pharynx and intestine, as well as the white ventral nerve cord. The 9 pairs of elytra are oval, delicate, somewhat inflated, without tubercles and papillae, the last pair very small (Fig. 5B). The elytophores are small (Fig. 5A, C). The dorsal cirri on the segments lacking elytra have long cylindrical cirrophores attached on the posterior sides of the notopodia, with very long, slender, delicate styles; dorsal tubercles are indistinct (Fig. 5A).

The bilobed prostomium is formed of 2 rounded lobes, without anterior extensions or frontal filaments; the median antenna has a slender cylindrical cera-

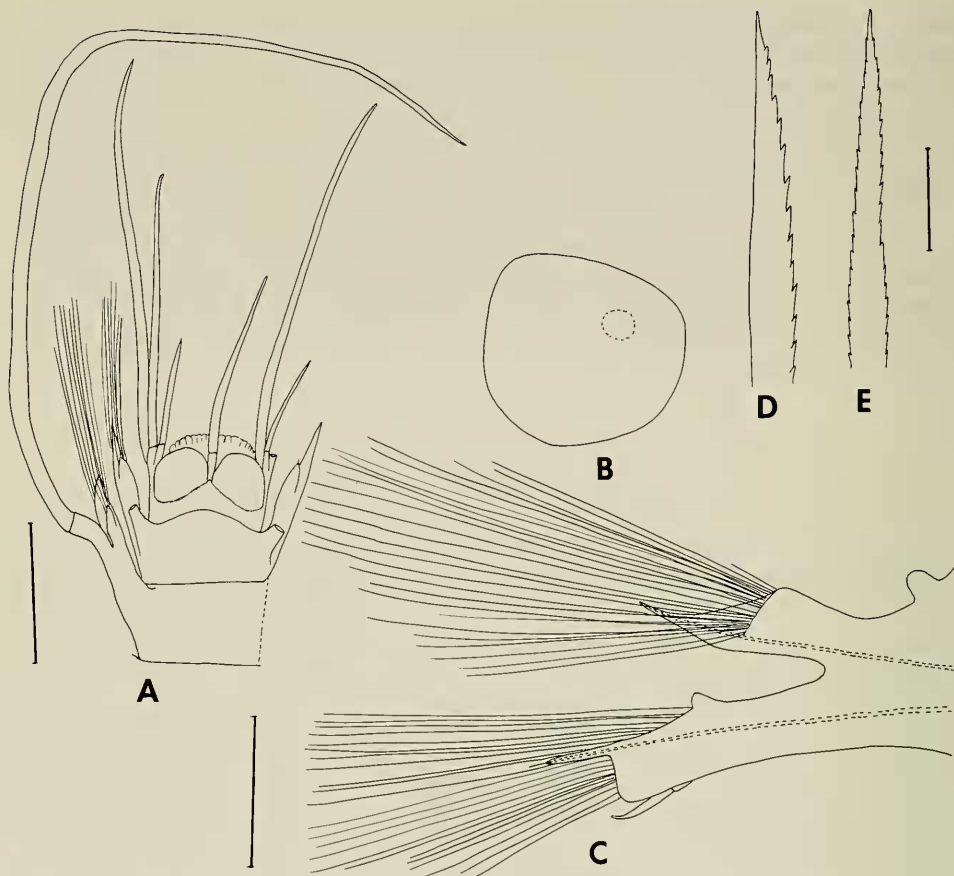


Fig. 5. *Natopolynoe kensmithi*, holotype, USNM 97450: A, Dorsal view of anterior end, pharynx partially extended, right ventral tentacular cirri and right parapodium of segment 3 missing; B, Elytron; C, Right elytrigerous parapodium, anterior view, acicula dotted; D, Tip of notoseta; E, Tip of neuroseta. Scales = 1.0 mm for A; 0.5 mm for B, C; 0.1 mm for D, E.

tophore inserted in the anterior notch, with a moderately long style; the very long palps are inserted ventrolaterally (Fig. 5A). The first or tentacular segment is visible dorsally, extending anteriorly between the lobes of the prostomium and laterally forming the achaetous tentaculophores for the 2 pairs of tentacular cirri, the ventral pair shorter than the palps but longer than the median antenna, and the dorsal pair shorter than the median antenna (Fig. 5A). The second or buccal segment bears the first pair of elytriphores, long biramous parapodia extending anteriorly and enclosing the prostomium, and ventral buccal cirri (broken off). The ventral mouth is enclosed in segments 1 and 2. The pharynx was not extended; when dissected out, it revealed 9 pairs of small oval dorsal and ventral papillae and 2 pairs of smooth amber-colored jaws.

Both rami of the biramous parapodia are very well developed, the notopodia only slightly shorter than the neuropodia, with both rami furnished with very numerous, long, transparent, flattened setae extending to the same level (Fig. 5C). The notopodium is conical, extending into a prominent acicular process. The

upper half of the neuropodium is diagonally truncate, extending into a prominent acicular process, the lower half truncate, with the short ventral cirrus attached near the distal end of the neuropodium. The delicate, flattened, transparent notosetae are slightly wider than the neurosetae, with more prominent serrations along one side, tapering to pointed tips (Fig. 5D). The flattened neurosetae have less prominent serrations on both sides and taper to sharp tips (Fig. 5E).

The pygidium is a small rounded lobe medial to the small parapodia of the last 2 segments; anal cirri were missing. Ventral nephridial papillae are indistinct.

Biology.—The holotype was collected during a dive of the *Alvin* in the Santa Catalina Channel in 1300 meters by Kenneth L. Smith using a slurp gun-respirometer. According to Dr. Smith (in litt., from Susan Hamilton), the worms were abundant not only on the bottom but also swimming in the water column up to about 10 meters above the sediment. Their long setae in motion were quite striking in the light of the camera's strobe. Other abundant organisms included holothurians, ophiuroids, chaetognaths, euphausiids, and a large medusa.

Etymology.—The species is named for Dr. Kenneth L. Smith of Scripps Institution, who managed to collect the holotype and made observations on the habitat of the species.

Remarks.—*Natopolynoe kensmithi* shows adaptations to a pelagic existence: the long biramous parapodia with numerous long flattened swimming setae in both rami and the delicate transparent integument of the body and elytra. Unfortunately, only a single specimen was collected. There is a possibility that the species may have more than 17 segments, with the last pair of small elytra on the last segment. The usual pattern in the Polynoidae is to have at least a few cirriferous segments following the last elytriferous segment.

In most features, *Natopolynoe kensmithi* agrees with the general characters of the genera and species of Macellicephalinae. It is closest to the recently described pelagic macellicephaline collected in a cave in the Bahamas, *Pelagomacellicephalo iliffei* (Pettibone 1985a:131). In the latter species, the tentacular segment is not visible dorsally, rather than distinctly visible; the pharynx has 5 pairs of unequal papillae and the jaws have numerous basal teeth, rather than 9 pairs of equal papillae and entire jaws; and the notosetae are few, short, and not flattened, rather than very numerous, long, and flattened.

Subfamily Harmothoinae Horst, 1917

Genus *Harmothoe* Kinberg, 1856

Harmothoe macnabi, new species

Figs. 6, 7

Material examined.—East central Pacific, from *Alvin* dive in the Galapagos Rift in 1979: MUSSEL BED, 00°47'53"N, 86°09'12"W, *Alvin* dive 895-32, 20 Feb, 2482 m, clam box washings, holotype (USNM 97451).

Description.—Length of holotype 33 mm, width with setae 14 mm, segments 28 plus 3 small regenerating segments and pair of long anal cirri (no doubt more than 32 segments and longer than 33 mm). The body is flattened, slightly tapering anteriorly and posteriorly. The elytra are located on the usual segments for *Harmothoe*: 2, 4, 5, 7, alternate segments to 23, 26, 29 (small developing elytra; and no doubt on 32 with few posterior segments with dorsal cirri). The elytra are large,

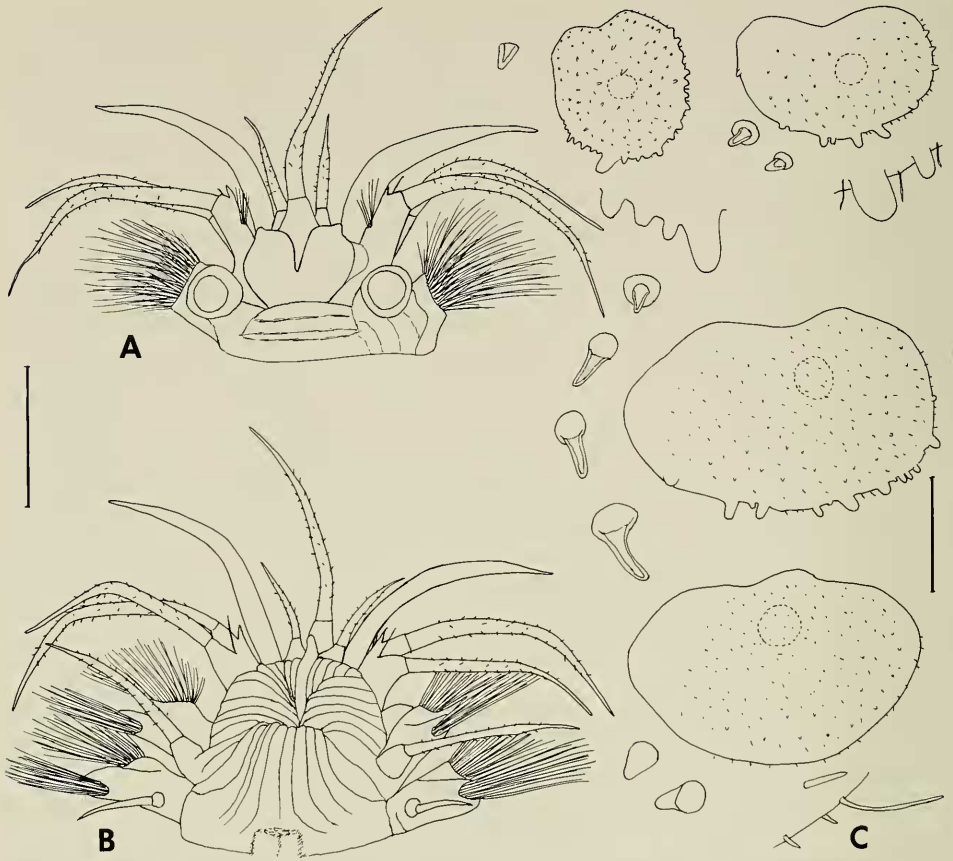


Fig. 6. *Harmothoe macnabi*, holotype, USNM 97451: A, Dorsal view of anterior end, turned slightly to left; B, Ventral view of anterior end; C, Right 1st, 2nd, middle, and posterior elytra, with detail of macro- and microtubercles and micropapillae. Scales = 2.0 mm for A, B; 2.0 mm for C.

covering the dorsum, round to oval, thick, white, opaque, with some macro- and microtubercles along the posterior border, variable in size and not set off from the surface (absent from more posterior elytra), with scattered conical microtubercles and long papillae on the surface and posterolateral borders but without a thick fringe of papillae (Fig. 6C). The elythro- and elytraphores are large and bulbous (Figs. 6A, 7B). On the segments lacking elytra, the dorsal cirri have long cylindrical cirrophores attached to the posterior sides of the notopodia, with long papillate styles extending far beyond the tips of the setae; the dorsal tubercles are conical (Fig. 7A). The dorsal tubercles are more elongated on segments 24, 25 and especially elongated and flattened, extending posterolaterally on segments 27 and 28.

The prostomium is bilobed, wider than long, with cephalic peaks; the median antenna has a large ceratophore inserted in the anterior notch, with a long papillate style about twice longer than the prostomium; the ceratophores of the lateral antennae are inserted ventrally and converge midventrally, with short papillate styles about half as long as the median antenna; the palps are stout, tapered,

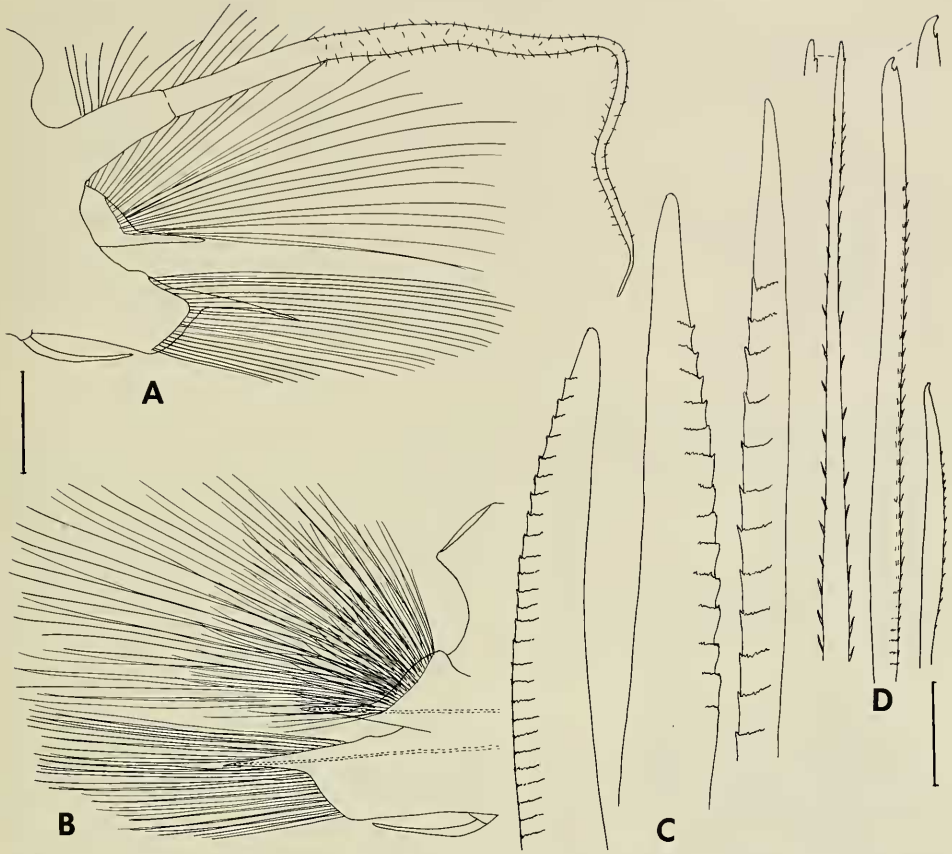


Fig. 7. *Harmothoe macnabi*, holotype, USNM 97451: A, Right cirriferous parapodium of segment 12, posterior view; B, Right elytrigerous parapodium of segment 13, anterior view, acicula dotted; C, Short and long notosetae; D, Upper, middle and lower neurosetae, with detail of tips. Scales = 1.0 mm for A, B; 0.1 mm for C, D.

smooth, slightly longer than the median antenna; eyes are lacking (Fig. 6A, B). The tentaculophores of the first segment are lateral to the prostomium, each with a small acicular lobe on the inner side, a pair of tentacular cirri similar to the median antenna, a group of 5–6 setae on the base of the dorsal tentacular cirrus and 1–2 setae on the base of the ventral tentacular cirrus; ventrally it forms the anterior and lateral lips of the mouth, with a distinct conical facial tubercle projecting anteriorly from the medial facial ridge (Fig. 6A, B). The second or buccal segment has a slightly-developed nuchal lobe and bears the first pair of elytriphores, well-developed biramous parapodia, and ventral buccal cirri with distinct ceratophores attached lateral to the posterior lip of the mouth, with long styles similar to the ventral tentacular cirri (Fig. 6A, B). The pharynx was not extended; when dissected, it showed the usual 9 pairs of papillae and 2 pairs of strong jaws.

The parapodia are biramous, both rami well developed with sharply pointed acicular processes (Fig. 7A, B). The notopodia are shorter than the neuropodia, rounded, with the acicular process on the lower side; the neuropodia have conical

Table 1.—Summary of identifications of polynoid polychaetes collected by DSRV *Alvin* in the areas of the Galapagos Rift (GR) in 1979 and in the East Pacific Rise (EPR) at 21°N in 1982, with number of specimens and references indicated.

	No. specimens (young)		Pettibone references
	GR	EPR	
Polynoidae Malmgren, 1867			
Harmothoinae Horst, 1917			
<i>Harmothoe</i> Kinberg, 1856			
<i>H. macnabi</i> , n. sp.	1		Present paper
Iphioninae Baird, 1865			
<i>Iphionella</i> McIntosh, 1885			
<i>I. risensis</i> Pettibone, 1985		7 (4)	1985d
Macellicephalinae Hartmann-Schröder, 1917;			
emend. Pettibone, 1976			
<i>Macellicephalo</i> McIntosh, 1885;			
emend. Pettibone, 1976			
<i>M. galapagensis</i> , n. sp.	1		Present paper
<i>Levensteiniella</i> n. gen.			
<i>L. kincaidi</i> n. sp.	45 (43)	124 (105)	Present paper
Lepidonotopodiinae Pettibone, 1983			
<i>Lepidonotopodium</i> Pettibone, 1983			
<i>L. fimbriatum</i> Pettibone, 1983		4 (1)	1983
		50 (31)	1984b
<i>L. riftense</i> Pettibone, 1984	112 (29)	313 (many)	
<i>L. williamsae</i> Pettibone, 1984	6	81 (many)	
Branchipolynoinae Pettibone, 1984			
<i>Branchipolynoe</i> Pettibone, 1984			
<i>B. symmytilida</i> Pettibone, 1984	77 (26)		1984a
Branchiplicatinae Pettibone, 1985			
<i>Branchiplicatus</i> Pettibone, 1985			
<i>B. cupreus</i> Pettibone, 1985		26 (12)	1985b
Branchinotogluminae Pettibone, 1985			
<i>Branchinotogluma</i> Pettibone, 1985			
<i>B. hessleri</i> Pettibone, 1985	3	33 (6)	
<i>B. sandersi</i> Pettibone, 1985	15 (3)	6 (1)	
<i>B. grasslei</i> Pettibone, 1985	1	24	
<i>Opisthotrochopodus</i> Pettibone, 1985			
<i>O. alvinus</i> Pettibone, 1985	6 (2)	43 (14)	

presetal lobes abruptly tapering to the acicular process (without a supra-acicular digitiform process) and shorter rounded postsetal lobes. The notosetae are very numerous, forming radiating bundles, as long as or longer than the neurosetae; they are much stouter than the neurosetae, short, slightly curved to long and straight, with spinous rows and blunt bare tips (Fig. 7C). The neurosetae are also very numerous, forming fan-shaped bundles, with bare slightly hooked tip and very small subterminal tooth; some lower ones with entire tips; with elongate spinous regions, the upper neurosetae with more prominent spines (Fig. 7D). The ventral cirri are short, smooth and tapered (Figs. 6B, 7A, B).

The small pygidium bears a pair of long anal cirri. The ventral nephridial papillae are small, beginning on segment 6.

Etymology. —The species is named for Professor James Macnab, my teacher at Linfield College, who first sparked my interest in the invertebrates of the Oregon coast.

Remarks. —This deep-sea eyeless species of *Harmothoe* from the Galapagos Rift in 2492 meters is closest to the recently described eyeless *H. vagabunda* from the North Atlantic off the Bahamas and Virgin Islands in 2066 and 3995 meters, from burrows of wood-boring bivalves (Pettibone 1985a:146). *Harmothoe vagabunda*, however, has very small or indistinct cephalic peaks; a distinct facial tubercle is lacking; the elytra lack macrotubercles; and all the neurosetae have bifid tips, with a long slender secondary tooth, thus differing from *H. macnabi*.

Summary

Over a thousand specimens of polynoid polychaetes, including many young ones, were collected during *Alvin* dives in the hydrothermal vents by the Galapagos Rift Biology Expedition in 1979 and the OASIS Expedition to the East Pacific Rise off Western Mexico at 21°N in 1982. They were sent to me for identification by J. F. Grassle of the Woods Hole Oceanographic Institution and K. L. Smith of Scripps Institution of Oceanography. Most of the collection has been dealt with the six papers (Pettibone 1983, 1984a, b, 1985b, c, d). The few remaining groups are covered in the present paper. The specimens are referred to seven subfamilies of Polynoidae, four of them new; nine genera, five new; and 13 new species, summarized in Table 1.

Of the 13 species, three were found only in the area of the Galapagos Rift: *Harmothoe macnabi* (single specimen), *Macellicephala galapagensis* (single specimen), and *Branchipolynoe symmytilida* (commensal with the deep-sea mussels). Three species were found only in the East Pacific Rise: *Iphionella risensis*, *Lepidonotopodium fimbriatum*, and *Branchiplicatus cupreus*. The other seven species were found in both localities. They may be separated by the following key.

Key to the Subfamilies, Genera, and Species of Polynoidae from the Galapagos Rift and East Pacific Rise at 21°N

1. Prostomium bilobed, with cephalic peaks; median antenna with ceratophore in anterior notch; lateral antennae with ceratophores inserted ventrally; with paired palps; without eyes. Tentaculophores of first segment lateral to prostomium, each with few setae and pair of tentacular cirri. Segments about 35. Elytra and bulbous elytraphores 15 pairs, on segments 2, 4, 5, 7, alternate segments to 23, 26, 29, and 32. Elytra thick, white, opaque, with scattered conical microtubercles on surface and some macrotubercles along posterior border, not set off from surface. Both rami of biramous parapodia with pointed acicular processes. Notosetae much stouter than neurosetae, with spinous rows and blunt bare tips. Neurosetae with spinous rows and bare slightly hooked tips with small subterminal tooth. Pharynx with 9 pairs of papillae and 2 pairs of jaws
..... Harmothoinae: *Harmothoe macnabi*, n. sp. (figs. 6, 7)
- Prostomium bilobed, forming two separate rounded lobes, with anterolateral bulbous extensions and paired palps; without lateral and median antennae and eyes. Tentaculophores of first segment lateral to prosto-

- mium, each with few capillary setae and pair of tentacular cirri. Segments 29. Elytra and bulbous elytriphores 13 pairs, on segments 2, 4, 5, 7, alternate segments to 23, and 26. Elytral surface divided into polygonal areas with secondary areolae and lateral fringe of papillae. Rami of biramous parapodia conical, closely allied. Notosetae bipinnate, capillary. Neurosetae stout, with close-set spinous rows and long bare slightly hooked tips, upper few slender, feathered. Pharynx with 9 pairs of papillae and 2 pairs of jaws
- Iphioninae: *Iphionella risensis* (Pettibone, 1985c, figs. 12–14)
- Prostomium with median antenna and paired palps, without lateral antennae and eyes. Tentaculophores of first segment lateral to prostomium, each with pair of tentacular cirri, without setae 2
 - 2. Body with paired segmental branchiae 3
 - Body without branchiae 8
 - 3. Prostomium truncate anteriorly, not bilobed, without frontal filaments; median antenna with ceratophore in middle of prostomium. Segments up to 35, first achaetous. Elytra 12 pairs, on segments 2, 4, 5, 7, alternate segments to 23. Elytra large, oval, covering dorsum. Branchiae beginning on segment 3, flattened elongate sacs, deeply folded and convoluted, attached to flattened elytriphores and dorsal tubercles, both with extra lobes. Parapodia biramous, both rami with projecting acicular processes. Notopodia without well-developed bracts. Paired palps, tentacular, buccal and dorsal cirri all long. Pharynx with 5 pairs of unequal papillae and 2 pairs of minutely denticled jaws
 - ... Branchiplicatinae: *Branchiplicatus cupreus* (Pettibone, 1985b, figs. 1–4)
 - Prostomium bilobed, anterior lobes with minute or filiform frontal filaments. Segments 21, first achaetous. Elytra 10 pairs on segments 2, 4, 5, 7, alternate segments to 19. Branchiae arborescent, in 2 main groups lateral to elytriphores and dorsal tubercles and on dorsal sides of notopodia. Elytriphores and dorsal tubercles not flattened, without extra lobes 4
 - 4. Bilobed prostomium with minute frontal filaments; ceratophore of median antenna indistinct, with short style. Elytra small, leaving middorsum uncovered. Parapodia subbiramous, notopodia small, digitiform, without bracts; notosetae few, stout, acicular; neuropodia short, truncate, without projecting acicular processes. Arborescent branchiae beginning on segment 2, with long terminal filaments. Paired palps, tentacular, buccal and dorsal cirri all short. Pharynx with 5 pairs of subequal papillae and 2 pairs of smooth jaws. Associated with deep-sea mussels
 - Branchipolynoinae: *Branchipolynoe symmytilida* (Pettibone, 1984a, figs. 1–8)
 - Bilobed prostomium with filiform frontal filaments; median antenna with distinct ceratophore in anterior notch. Elytra large, covering dorsum. Parapodia biramous, both rami with projecting acicular processes; notopodia with prominent bracts on elytrigerous segment 2 or on all elytrigerous segments. Notosetae numerous, stout, acicular. Arborescent branchiae beginning on segment 3, compact, with short terminal filaments. Paired palps, tentacular, buccal and dorsal cirri all long. Pharynx

- with 5 papillae: 3 dorsal and 2 ventral; 2 pairs of minutely denticled jaws. Branchinotogluminae (Pettibone, 1985c) 5
5. Posterior 4 segments (18–21) compressed, with parapodia greatly modified, including wheel organs on segment 20. Notopodia with prominent rounded bracts on elytrigerous segments 2–17. Arborescent branchiae on segments 3–17, with rather long terminal filaments. Dorsal tubercles elongate, tapered. Notosetae stout, acicular, smooth or with 1–2 rows of spines. With pair of elongate ventral papillae on segment 12, and 5 pairs of short rounded lamellae on segments 13–17 *Opisthotrochopodus alvinus* (Pettibone, 1985c, figs. 7–9) 5
- Posterior 4 segments not compressed or only posterior 3 segments (19–21) slightly modified, without wheel organs on segment 20. *Branchinotogluma* (Pettibone, 1985c) 6
6. Prominent notopodial bracts on all elytrigerous segments. Arborescent branchiae with rather long terminal filaments. Posterior segments not modified, with branchiae on all segments from segment 3 on. Dorsal tubercles projecting posteriorly. Notosetae stout, acicular, smooth or with 2 rows of spines. With 6 pairs of small, rounded lamellae on segments 11–16 *Branchinotogluma hessleri* (Pettibone, 1985c, figs. 1, 2) 6
- Notopodial bracts on elytrigerous segment 2 only. Arborescent branchiae with short terminal filaments. Dorsal tubercles inflated, indistinct. Notosetae stout, acicular, smooth 7
7. Posterior 3 segments slightly compressed and modified, with branchiae absent from segments 19–21. With 4 pairs of elongate ventral papillae on segments 12–15 and 3 pairs of rounded lamellae on segments 16–18 *Branchinotogluma sandersi* (Pettibone, 1985c, figs. 3, 4) 7
- Posterior segments not compressed or modified, with branchiae on all segments from segment 3 on. Without elongate ventral papillae; with or without 5 pairs of small, squarish papillae on segments 11–15 *Branchinotogluma grasslei* (Pettibone, 1985c, figs. 5, 6) 7
8. Biramous parapodia with well-developed bracts encircling notopodia anteriorly and dorsally. Neuropodia diagonally truncate, deeply notched dorsally. Segments up to 30, first achaetous. Elytra 11 pairs, on segments 2, 4, 5, 7, alternate segments to 21. Prostomium deeply bilobed, with small frontal filaments on anterior lobes, with ceratophore of median antenna inserted in anterior notch. Lepidonotopodiinae: *Lepidonotopodium* (Pettibone, 1983, 1984b) 9
- Notopodia of parapodia without bracts. Both rami of parapodia with projecting acicular processes. Macellicephalinae (sensu Pettibone, 1976) 11
9. Prostomium with prominent cylindrical anterior lobes. Elytral surface covered with numerous conical microtubercles and scattered micropapillae, without raised macrotubercles. Notosetae much stouter than neurosetae, with spinous rows on distal part. Upper neurosetae with 2 rows of prominent spines; lower neurosetae minutely spinous. Pharynx with 7 pairs of subequal papillae; 2 pairs of jaws with 5–7 basal teeth. With or without 4 pairs of elongate ventral papillae on segments 12–15 *Lepidonotopodium williamsae* (Pettibone, 1984b, figs. 5, 6) 11

- Prostomium with subtriangular anterior lobes. Notosetae similar in width to neurosetae, with relatively few (4–9) widely-spaced spines along one side. Upper neurosetae not markedly differing from lower ones. With or without long ventral papillae on segments 11 and 12 10
- 10. Elytra with 2 raised macrotubercles per elytron and numerous microtubercles and scattered globular micropapillae. Pharynx with 7–9 pairs of papillae, unequal in size; jaws with few basal teeth (5–9)
 *Lepidonotopodium fimbriatum* (Pettibone, 1983, figs. 1–5; 1984b, fig. 1)
- Elytra without raised macrotubercles, with scattered clavate micropapillae, with or without variable number of small projections. Pharynx with 7–9 pairs of equal papillae; jaws with numerous basal teeth
 *Lepidonotopodium riftense* (Pettibone, 1984b, figs. 3, 4)
- 11. Prostomium bilobed, with lobes rounded, without frontal filaments. Segments 18, first achaetous. Elytra 9 pairs, on segments 2, 4, 5, 7, alternate segments to 17. Elytra very small, thick. Notosetae few, about as stout as neurosetae, with widely spaced spinous rows and rounded tips. Neurosetae delicate, flattened, with double rows of widely spaced spines. Ventral papillae indistinct. Pharynx with 9 pairs of equal papillae; jaws entire *Macellicephala galapagensis*, n. sp. (fig. 4)
- Prostomium deeply bilobed, with anterior lobes triangular, with frontal filaments. Segments up to 25, first achaetous. Elytra 11 pairs, on segments 2, 4, 5, 7, alternate segments to 21. Elytra large, covering dorsum, delicate. Notosetae numerous, stouter than neurosetae, with spinous rows and blunt tips. Neurosetae spinous, with slightly hooked and tapered tips, not flattened. With or without elongate ventral papillae on segments 11 and 12. Pharynx with 7 pairs of equal papillae; jaws entire *Levensteiniella kincaidi*, n. gen., n. sp. (figs. 1–3)

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Literature Cited

- Levenstein, R. J. 1982. New genera of the subfamily Macellicephalinae (Polychaeta, Polynoidae) from the Tasman Hollow.—*Zoologicheskoy Zhurnal* 61(9):1291–1296. [In Russian, English summary].
- Pettibone, M. H. 1976. Revision of the genus *Macellicephala* McIntosh and the subfamily Macellicephalinae Hartmann-Schröder (Polychaeta: Polynoidae).—*Smithsonian Contributions to Zoology* 229:1–71.
- . 1983. A new scale worm (Polychaeta: Polynoidae) from the hydrothermal rift-area off Western Mexico at 21°N.—*Proceedings of the Biological Society of Washington* 96(3):392–399.

- . 1984a. A new scale-worm commensal with deep-sea mussels on the Galapagos hydrothermal vent (Polychaeta: Polynoidae).—Proceedings of the Biological Society of Washington 97(1): 226–239.
- . 1984b. Two new species of *Lepidonotopodium* (Polychaeta: Polynoidae: Lepidonotopodinae) from hydrothermal vents off the Galapagos and East Pacific Rise at 21°N.—Proceedings of the Biological Society of Washington 97(4):847–863.
- . 1985a. Polychaete worms from a cave in the Bahamas and from experimental wood panels in deep water of the North Atlantic (Polynoidae: Macellicephalinae, Harmothoinae).—Proceedings of the Biological Society of Washington 98(1):127–149.
- . 1985b. An additional new scale worm (Polychaeta: Polynoidae) from the hydrothermal rift-area off Western Mexico at 21°N.—Proceedings of the Biological Society of Washington 98(1): 157–164.
- . 1985c. Additional branchiate scale-worms (Polychaeta: Polynoidae) from Galapagos hydrothermal vent and rift-area off Western Mexico at 21°N.—Proceedings of the Biological Society of Washington 98(2):443–465.
- . 1985d. Review of the Iphioninae (Polychaeta: Polynoidae) and revision of *Iphione cimex* Quatrefages, *Gattyana deludens* Fauvel, and *Harmothoe ipionelloides* Johnson (Harmothoinae).—Smithsonian Contributions to Zoology [in press].

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